

ANNUAL REPORT 1976/77

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SECTION 1 INTRODUCTION

1976/77 was an important year for the Computer Laboratory as a result of the installation of a major new machine, the DECsystem-20, which was delivered in July. Because of the installation date, it did not ease the pressure on the Laboratory during the academic year and the associated preinstallation activities including physical planning, software preparation, staff training, and contract negotiations made considerable demands on Laboratory manpower during the busy period. However, it was fully operational by the end of September and is expected to carry an increasing proportion of the Laboratory's workload over the next few years as the System/360 is gradually phased out of service.

Otherwise, the general pattern of Laboratory activity was maintained. The heavy demand for service continued and such marginal improvements as were possible by tuning the existing software and equipment and by the use of unattended running were largely offset by a reduction in machine availability due to equipment breakdowns and power cuts. It was possible, however, to avoid the introduction of a rationing system for computer time and as a result of the new machine, it is hoped that the crisis situation has now passed.

SECTION 2 MACHINE UTILISATION

2.1 Computer Activity

The analyses of computer activity contained in this report are again expressed in financial terms and reflect, as closely as possible, the actual costs expended in providing the services concerned. This procedure, which was used for the first time in last year's report, is explained in Appendix C.

The general level of use was only slightly higher than the preceding year. This was partly due to the fact that the existing equipment has virtually reached saturation point, and to a decrease of machine availability from 6766.8 hours in 1975/76 to 6533.3 hours in 1976/77. The latter decrease was mainly due to a sharp increase in machine maintenance time which at 235.62 hours, was the highest ever experienced and reflects the age of the equipment. Power cuts arising from the ESB dispute also contributed to the decrease in availability.

Analysis of Computer Use

Total Monthly Use per User Category

		User Category				
Month	Library	Academic	Admin	Outside	Systems Support	Total
10/76	1357.92	4759.14	5369.98	572.46	1053.76	13113.26
11/76	1451.78	8250.62	2446.74	225.32	1712.02	14086.48
12/76	1190.75	7556.95	2213.40	263.53	1416.23	12640.86
1/77	1002.62	8319.64	2449.76	292.80	1822.29	13887.11
2/77	1912.92	9584.00	2339.54	396.06	1787.26	16019.78
3/77	1765.41	11116.21	2078.53	448.12	2094.53	17502.80
4/77	1904.69	10815.60	2805.89	636.08	1789.71	17951.97
5/77	1586.97	9760.17	1954.97	490.49	1596.94	15389.54
6/77	1685.71	8205.66	2090.46	665.14	1438.94	14085.91
7/77	2176.36	6509.34	2259.95	886.62	1186.13	13018.40
8/77	2875.66	5831.96	2021.18	712.46	902.13	12343.39
9/77	1660.36	3795.44	3599.05	612.50	1076.15	10743.50
Overall	20571.15	94504.73	31629.45	6201.58	17876.09	170783.00

- "Systems Support" includes central software maintenance, etc., and certain GUTS use which it is not feasible to analyse, by Library, Academic and Administrative users.

Analysis of Computer Use

Percent of Total Monthly Use per User Category

	User Category						
Month	Library	Academic	Admin	Outside	Systems Support		
	*	Å	e e	<i>A</i>	4 0		
10/76	10.36	36.29	40.95	4.37	8.04		
11/76	10.31	58.57	17.37	1.60	12.15		
12/76	9.42	59.78	17.51	2.08	11.20		
1/77	7.22	59.91	17.64	2.11	13.12		
2/77	11.94	59.83	14.60	2.47	11.16		
3/77	10.09	63.51	11.88	2.56	11.97		
4/77	10.61	60.25	15.63	3.54	9.97		
5/77	10.31	63.42	12.70	3.19	10.38		
6/77	11.97	58.25	14.84	4.72	10.22		
7/77	16.72	50.00	17.36	6.81	9.11		
8/77	23.30	47.25	16.37	5.77	7.31		
9/77	15.45	35.33	33.50	5.70	10.02		
Overall	12.05	55.34	18.52	3.63	10.47		

 The percentages in this table are based on the cost distribution shown in Table 1.

- "Systems Support" includes time required for central software maintenance, central systems software operation, and "housekeeping" activities. In addition, it contains certain GUTS use by Library, Academic and Administrative applications which it is not feasible to analyse further.

Month	GUTS Availability (Hours)	Terminal Time Used (Hours)	User "Log-on" Requests	Jobs Submitted via GU TS
10/76	368.06	842.18	3552	3383
11/76	317.30	2071.98	6944	6760
12/76	236.50	1605.10	5820	5339
1/77	226.93	1710.87	6585	5326
2/77	237.22	2014.23	8215	6810
3/77	246.34	2054.70	7444	6986
4/77	177.98	1795.17	6945	5057
5/77	215.42	1698.37	7364	5762
6/77	268.82	1003.17	4362	4750
7/77	266.23	1099.88	5177	4863
8/77	287.34	825.65	3634	3912
9/77	260.95	554.32	2318	2549
Total	3109.09	17275.62	68360	61497

	Cost - £			
Department	Research	Teaching	Total	
Computer Science	12005.80	39076.80	51082.60	
Statistics	11395.81	1512.77	12908.58	
Engineering	5465.34	1090.43	6555.77	
Chemistry	5421.47	719.40	6140.87	
Business Studies	449.66	2485.64	2935.30	
Genetics	2555.26	0	2555.26	
Zoology	52.99	2103.21	2156.20	
Education	1434.76	267.81	1702.57	
Economics	1409.20	212.25	1621.45	
Geography	328.98	970.88	1299.86	
Physics	748.62	162.16	910.78	
Pure Mathematics	521.92	386,62	908.54	
Social Studies	587.77	225.47	813.24	
Obstetrics & Gynaecology	641.82	0	641.82	
Pharmacology	493.17	0	493.17	
Psychology	469.86	19.16	489.02	
Community Health	437.00	0	437.00	
Veterinary Medicine	286.09	0	286.09	
Biochemistry	147.45	0	147.45	
Applied Mathematics	85.64	39.85	125.49	
Political Science	0	79.60	79.60	
Botany	76.45	0	76.45	
Sociology	20.18	53.53	73.71	
Clinical Medicine	47.98	0	47.98	
Geology	13.58	0	13.58	
Dentistry	0	2.35	2.35	
Total	45096.80	49407.93	94504.73	

Analysis of Academic Use by Department - Percentage : *****.;

	Percent of Total Computer Use			
Department	Research	Teaching	Total	
Computer Science	7.02	22.88	29.90	
Statistics	6.67	0.89	7.56	
Engineering	3.20	0.64	3.84	
Chemistry	3.17	0.42	3.59	
Business Studies	0.26	1.46	1.72	
Genetics	1.50	0	1.50	
Zoology	0.03	1.23	1.26	
Education	0.84	0.16	1.00	
Economics	0.83	0.12	0.95	
Geography	0.19	0.57	0.76	
Physics	0.44	0.09	0.53	
Pure Mathematics	0.31	0.23	0.54	
Social Studies	0.34	0.13	0.47	
Obstetrics & Gynaecology	0.38	0	0.38	
Pharmacology	0.29	0	0.29	
Psychology	0.28	0.01	0.29	
Community Health	0.26	0	0.26	
Veterinary Medicine	0.17	0	0.17	
Biochemistry	0.09	0	0.09	
Applied Mathematics	0.05	0.02	0.07	
Political Science	0	0.05	0.05	
Botany	0.04	0	0.04	
Sociology	0.01	0.03	0.04	
Clinical Medicine	0.03	0	0.03	
Geology	0.01	0	0.01	
Dentistry	0	0.00	0.00	
Total	26.41	28.93	55.34	

	Cost - £				
Application	Development and Maintenance	Production	Total		
Accessions System	14.90	6452.62	6467.52		
Catalogue System	1528.51	11698.64	13227.15		
SDI Service	30.06	846.42	876.48		
	1573.47	18997.68	20571.15		

Table 6

	Percent of Total Computer Use			
Application	Development and Maintenance	Production	Total	
Accessions System	0.01	3.78	3.79	
Catalogue System SDI Service	0.90 0.01	6.85 0.50	7.75 0.51	
Total	0.92	11.13	12.05	

Analysis of Administrative Use Cost

		Cost - £	
Application	Development and Maintenance	Production	Total
Admissions	109.54	972.34	1081.88
Student Records	1945.75	6314.02	8259.77
Examination Processing	0	177.82	177.82
Staff Statistics	85.10	621.40	706.50
Salaries	296.66	2887.87	3184.53
Wages	143.01	3276.95	3419.96
Debtors Ledgers including fees and Incidentals Creditors	1209.87	5342.57	6552.44
Ledgers	0	763.60	763.60
Nominal Ledger	729.37	6564.38	7293.75
Others	135.16	54.04	189.20
Total	4654.46	26974.99	31629.45

Analysis of Administrative Use Percent

	Percen	t of Total Compu	iter Use
Application	Development and Maintenance	Production	Total
Admissions	0.06	0.57	0.63
Student Records	1.14	3.70	4.84
Examination Processing	0	0.10	0.10
Staff Statistics	0.05	0.36	0.41
Salaries	0.17	1.69	1.86
Wages	0.08	1.92	2.00
Debtors Ledgers including fees and incidentals	0.71	3.13	3.84
Creditors Ledgers	0	0.45	0.45
Nominal Ledger	0.43	3.85	4.28
Others	0.08	0.03	0.11
Total	2.72	15.80	18.52

Total System Elapsed House

	Machine Use					
Month	GUTS	OS Alone	Other	Total	Maint- enance	Total Activity
10/76	368.06	236.55	2.90	607.51	1.83	609.35
11/76	317.30	242.45	0.68	560.43	0 .9 8	561.41
12/76	236.50	215.32	0.0	451.82	2.28	454.10
1/77	226.93	271.52	0.20	498.65	0.0	498.65
2/77	237.22	293.46	0.10	530.78	0.0	530.78
3/77	246.34	285.42	1.35	533.10	42.13	575.23
4/77	177.98	380.36	21.83	580.18	3.12	583.30
5/77	215.42	349.16	0.0	564.58	0.0	564.58
6/77	268.82	254.15	0.0	522.97	4.98	527.95
7/77	266.23	276.45	3.20	545.88	60.43	606.31
8/77	287.34	321.70	0.0	609.03	1.17	610.20
9/77	260.95	267.75	0.0	528.70	118.68	647.38
Total	3109.09	3394.28	30.27	6533.62	235.62	6769.23

- GUTS : Gothenburg Universities Terminal System
- 0.S. : Operating System/360. This is the main multi-programming control program in use.
- Other : "Stand-alone" use of the system without the normal control program.

2.2 Ancillary Operations

The total amount of data preparation undertaken by the Laboratory for users decreased by about thirty percent due largely to the increased use of terminals for data entry purposes by the Library and administrative users. The total consumption of punched cards did increase due mainly to the provision of additional keypunching facilities for academic users and an increase in the production of punched card output by the computer.

DATA PREPARATION

Cards punched by the Laboratory for:

- Academic users	:	2900
- The Library	:	52700
- The Administration	:	145800
- Outside Users	:	6100
Cards punched by outside agencies	:	17900

	-	-				•	1,200
Cards	punched	Ъy	users	thems	selves	:	672000
Cards the d	punched	aut	tomatio	cally	by	:	447000

3.1 Library

The very considerable task of documenting the existing Library systems was satisfactorily completed during the year and as a result it was possible to relieve the development section of the responsibility for day-to-day operation of the Library Catalogue subsystem which can now be processed on a routine basis by the Operations Section. The position of Systems Analyst responsible for Library development was vacant for a six month period following Mr. Tucker's resignation. However, in addition to the documentation task a number of minor studies were carried out which included a review of Library computer file security which resulted in the introduction of some new procedures, an investigation of the currently available microfilm readers for the purpose of identifying a more reliable machine for Library use, and a more comprehensive study to investigate the possible use of microfiche instead of microfilm which commenced in September.

3.2 Academic

The general pattern of academic computer use remained relatively unchanged during 1976/77. The User Services Group was increased to two people at the beginning of the year and made some improvement possible in the quality of advice and availability of documentation. Unfortunately, a resignation in April reduced its strength once more but it is hoped that this will be satisfactorily filled shortly. During the year some additional data preparation facilities were made available to academic users.

3.3 Administration

No major new administrative applications were introduced during the year. In the financial area, the nominal ledger application referred to in last year's report went into operation at the beginning of the year and operated satisfactorily. Following the successful use last year of a terminal in the Accountant's Office for data entry it was decided to extend the use of terminals for administrative data collection in the future and plans were made for the provision of data transmission lines to East and West Theatres. A terminal was introduced in September for the recording of fee payments. The Buildings Office costing application was, however, discontinued during the year. In the field of student administration, the new student records system was in regular operation by the year end. The main changes in this area were in the admissions field where new procedures were required to work with the CAO. These worked reasonably well although a number of minor difficulties were experienced. The new DECsystem-20 performed its first administrative task in the admissions application when it was used to provide terminal access to the CAO file of applications for the purposes of recording decisions.

SECTION 4 CENTRAL SERVICE DEVELOPMENT

4.1 Hardware

The Gandalf 640 PACX, ordered last year, was installed in December together with its associated modems. This, and a second Post Office line for users outside the main College area, made possible better utilisation of the terminal system by permitting all terminals to compete for access even when the central system runs unattended.

By far the most significant development during the year was the installation in July of the new DECsystem-20 together with its associated terminals. No major problems were encountered during the installation of the machine which completed its acceptance tests satisfactorily on July 15th. From then to the end of the year it was used mainly for development and familiarisation purposes by Laboratory staff and selected users, largely from the Department of Computer Science, and was ready to enter regular service by the end of September.

An additional keypunch was installed for academic users in January and ten visual display terminals for general use were installed in September.

4.2 Software

The operating system for the DECsystem-20, TOPS-20, was the most significant addition made to the Laboratory's software during the year. This, in combination with the DEC equipment, offers users in Trinity a generally available fully-interactive facility for the first time and an apparent memory work-space more than six times greater than the maximum available to users on the existing System/360. The DEC software includes a range of programming languages corresponding to those on the 360 and with the exception of PL/I which is available in an interpretive version only, all may be used interactively or in batch mode. In addition, the APL language, which has not been available in College in the past, is included.

SECTION 5 OTHER ACTIVITIES

5.1 Teaching and Publications

The Computer Laboratory Newsletter was revived at the beginning of the year by the newly formed User Services Group and appeared on six occasions. As in other years, lectures were given by the Assistant Director to medical undergraduates and by the Director to MBA and M.Sc. students.

5.2 Sale of Services

Contrary to expectations, revenue from the sale of computer services rose to £11,632 from £9,444 last year. The reliable prediction of this is difficult due to the small number of customers involved but it is hoped that a further increase will be experienced during the coming year as the introduction of the DECsystem-20 makes more capacity available for outside users on the System/360.

5.3 External Contacts

During the year, the Laboratory joined DECUS, the DEC international users group and was represented at its 1977 European conference and at a number of regional meetings by the Assistant Director. In view of the limited future role of the IBM system it was decided to withdraw from GUIDE, one of the two IBM European user groups of which the Laboratory was a member. Membership of SEAS, the scientifically oriented IBM user group, has been retained and the Laboratory was represented by the Director at its main annual conference, SEAS77, in Cambridge. Benchmark tests prior to ordering the DEC machine were carried out in the United States by the Professor of Computer Science and the Director and, while there, an opportunity was taken to visit a number of DEC users including the Harvard Business School and Bentley College. Visits were also made to other DEC university installations in Dundee, by the Assistant Director and Systems Programmer, and the Open University by the Operations Manager.

The Joint Working Group on Information Systems remained active throughout the year and meetings were held at the HEA, Maynooth, UCC, UCD and UCG.

SECTION 6 FUTURE DEVELOPMENTS

The installation of the DECsystem-20 has defined the equipment environment within which the Laboratory will develop for several years to come. In the short term, the new machine in its present form will be integrated into the day-to-day running of the Laboratory working alongside the System/360 and it is hoped that it will then be expanded over a number of years to assume the entire workload, at which stage the IBM machine will be withdrawn from service. The date at which this will happen will depend on a number of factors, both economic and technical, including the performance and reliability of each machine, maintenance costs, and equipment prices. The need to convert existing library and administrative programs, written in PL/I, to COBOL for operation on the DEC will also be a major consideration. It is likely to happen sometime in the period 1979 to 1981. The HEA Advisory Group on Computer Services met regularly during the year and accepted proposals from Trinity for some enhancement of the DEC system during 1978 subject to the availability of funds.

It is planned to introduce a data transmission link between the Laboratory and the UCD Computer Centre to provide users in each installation with access to complementary facilities in the other. This development will be closely monitored to ensure that no unreasonable demands are made on either host installation and, if successful, may be expanded in the longer term to include links to the computer installations in UCC and UCG, should this prove desirable.

During the last quarter of 1976/77, a review was carried out of the Computer Laboratory organisation with a view to the possible introduction of an updated structure to more appropriately match the requirements of the next few years. It is hoped that recommendations will emerge which can be implemented during 1977/78.



APPENDIX A

EQUIPMENT

The specifications of the equipment currently installed are as follows:

IBM System 360:

- 1 x IBM 2044 Model H Central Processing Unit with 262,144 bytes (256K) of core storage and with
 - One Multiplexor Channel
 - Two high speed multiplexor channels
 - Single disc storage drive in CPU
 - Store and fetch protection
 - Floating point arithmetic
 - Console printer keyboard
 - Interval timer
 - Commercial Feature (Full 360 instruction set)
 - High Speed General Registers
- 1 x IBM 2941 Model 1 Storage Control with
 - File Scan and
 - Record Overflow
- 1 x IBM 2415 Model 4, Magnetic Tape Unit and Control
 (2 drives) with 9-track compatibility,
 i.e., 800 b.p.i. tape at 15000 b.p.s.
 or 1600 b.p.i. tape or 30000 b.p.s.
- 1 x IBM 2821 Model 2 Control Unit (for 1403 printer)

- 1 x IBM 1403 Model 2 Printer with Universal Character Set feature and interchangeable Chain Cartridge adapter Print positions: 132 Maximum Rated Speed: 600 Lines/minute Chains: Normal - PN3 Also Available: TN modified for Library Use & QN2
- 1 x IBM 2501 Model B2 Card Reader with Card Image Feature
- 1 x IBM 1442 Model N2 Card Punch with Card Image Feature Speed: 91 to 256 cards/minute depending on number of columns punched.
- 1 x IBM 1053 Model 4 Printer with pin-feed platen and accelerated carriage return
- 4 x IBM 2311 Model 1 Direct Access Storage Units
- 1 x IBM 2314, 2312 and 2312 Model Al Direct Access
 Storage Facility (5 spindles)
- 1 x IBM 3704 Transmission Control Unit

Burroughs B1700:

- 1 x B1700 System in the Department of Computer Science comprising:
 - B1714 CPU and SPO including 40K memory
 - A9480-12 Dual Disc Unit
 - A9115 Card Reader
 - A9349.2 Line Printer

- 1 x 2040 CPU with 128K words of memory and 16 asynchronous communication ports
- 2 x RPO6 200 Mbyte disc drives
- 2 x TU45 120 Kb, 9-track, 800/1600 b.p.i. tape drives
- 1 x CD20-A 300 card/minute Card Reader
- 1 x LP20-AB 300 line/minute 64 character printer

Terminals:

To IBM System only:

- 8 x IBM 2260 Display Stations Model 1
 with alphanumeric keyboards
- To IBM or DEC Systems, via a CASE 640/2(M) PACX:
 - 10 x Hazeltine 1500 Visual Display terminals
 - 1 x LA36 DECwriter printing terminal

In addition to the above terminals which are located in public areas for general use, 12 Laboratory terminals are located within user departments and a number of user owned machines have access to the system.



APPENDIX B

STAFF

The Laboratory has a staff of 26 organised as shown in Figure B.1. The functions of the main groups are as follows:

DEVELOPMENT STAFF

This section is responsible for the development of new applications, as follows:-

Systems Analysts study the requirements of new systems in the library and administrative fields and design computer based procedures to implement them.

<u>Programmers</u> write and test the computer programs called for by the Systems Analysts' designs. They also act as advisors to academic users who do their own programming.

Systems Programmers. Systems Programmers are responsible for the generation and maintenance of internal control programs needed to run the computer.

OPERATIONS STAFF

This section is responsible for the day-to-day operation of the Laboratory and duties are as follows:-

Data preparation and control is performed by <u>Data</u> <u>Processing Assistants</u> and consists of card punching and verification, reception and dispatch of work, and control of the magnetic disc and tape library and of documents in progress. Computer operation is performed by <u>Operators</u> who are normally organised into teams of two people, one of whom is shift leader. Operators work permanently on a shift rota.

Janitors work on permanent night shift and are responsible for general security.



Figure B.1

APPENDIX C

COSTS

The services provided by the Laboratory may be divided into three groups:

 <u>Computer Service</u> consisting of computer time together with the appropriate materials and supporting facilities. This is available to all college departments and to outside users.

2. Application Development Service

This is a full systems analysis and programming service provided for library and administrative applications design. The Laboratory staff who perform this work normally use the "Computing Service" and "Data Preparation Service" for test purposes on behalf of the user departments.

3. Data Preparation Service

This is, at present, a card punching service provided on a limited scale to all user sectors.

The total cost of running the Laboratory is shown in Table C.1 under the main expenditure headings used in the College accounts. The cost of providing each of the three services was determined by analysing all the categories of expenditure shown in Table C.1 to estimate the fraction of each used to provide each of the three services. For example, in the case of salaries the cost of Systems Analysts is charged to Application Development, Operators to Computer Service, while the cost of others such as the Director is distributed over the three in proportion to the estimated effort spent on each by the individuals concerned. For the purpose of "charging", this analysis was carried out at the beginning of the year on the budget figures and the resulting estimated cost of Computer Service was used as a target to be recovered during the year. This together with estimates of the level of usage were used to determine the rates to be charged for those activities which constitute "Computer Service". Since the resulting rates were very close to those used in 1975/76, the latter were retained without change for 1976/77. These rates are shown in Table C.2. In Hilary term, when details of the additional funds for the new machine became known, the budget was increased substantially. The "charging" rates were not altered at that time, however, for practical reasons but the total recovered was scaled up appropriately prior to use in this report. It is interesting to note that this capital repayment element and, to a lesser extent, inflation have increased the unit cost of computing by about 45% from the unrealistically low figure which prevailed for some years after the cost of the IBM machine was written off.

Table C.3 shows use of the three services by user category.

COMPUTER LABORATORY

ACCOUNTS

Year Ended 30 September 1977

Expenditure:

	Actual	Budget
Cost of Staff:	£	£
- Salaries	117,975	125,300
- Wages	6,781	7,170
Rentals of Equipment	18,311	19,950
Purchases of Ancillary Equipment	37,947	28,800
Maintenance	27,641	25,610
Consumable Supplies	11,207	10,800
Cost of External Services	470	800
Insurance Charges	1,283	1,160
Miscellaneous Expenses	2,900	3,060
Recurrent Cost for Year	224,515	222,650

Income:

Income from Sale of Computer Services - £11,632

This includes income amounting to £483.42 from computer use by externally funded research activities undertaken by the following departments:

Business S	Studies	£162.24
Statistics	S	321.18
		£483.42

Table C.1

UNIVERSITY OF DUBLIN TRINITY COLLEGE COMPUTER LABORATORY

INTERNAL CHARGES

Charges applicable to Normal Batch and GUTS Work

Virtual Time (Note 1)	£0.12	per requested 2Kb/hour
CFU Time	£7.92	per hour
2311 Disk I/O	£0.0004	per EXCP
2314 Disk I/O	£0.0002	per EXCP
2415 Tape I/O	£0.0004	per EXCP
Special Diskpack or Tape Mounting (Note 2)	£0.50	per volume
Input via HASP	£0.0003	per card image
Output via HASP (Note 3)	£0.0003	per line image
	£0.0089	per card punched
Special Printer Set-up	£1.00	per set-up

Additional Charges for GUTS Work

"Log-on" Time	£0.0289	per minute
Input from Terminal	£0.0002	per line
Output to Terminal	£0.0002	per line
Foreground Execution (T.S.)	£0.024	per second

- Note 1 Virtual Time is an artificial approximation to elapsed time based on an amalgam of several factors and is the basis for charging for memory occupancy.
- Note 2 Requests for 2314 disk mounting will not normally be entertained.
- Note 3 In the case of 1403 output this includes the cost of standard single part stationery.

User Category	Computer Service Note 1	Application Development Service Note 2	Data Prep. Service	Total
Academic	105553	0	175	105728 (47.09%)
Library	22976	13185	2130	38291 (17.05%)
Administrative	35327	31441	6495	73263 (32.63%)
Outside	6927	0	306	7233 (3.22%)
Total	170783	44626	9106	224515

- Note 1: "Systems Support" use is included as an overhead in these costs.
- Note 2: This breakdown is approximate and based on the total development cost distributed in proportion to the number of development staff assigned.

APPENDIX D

GLOSSARY

CPU	: Central Processing Unit, the major com-
	ponent of a computer system. In the
	College there are three CPUs, an IBM 2044,
	a DEC 2040, and a Burroughs B1714.

- CPU Time : Time during which the CPU is actively processing and not waiting for a peripheral device to complete some ancillary operation.
- Development Use : Use of the system by systems analysis and programming staff for the development of new applications or of major enhancements to existing ones including the productive running of new programs prior to their transfer to the Operations Section for routine use.
- Elapsed Time : Overall time span from start to finish on the whole system. Individual components may not be active for all of this period.
- GUIDE : The European GUIDE organisation. An association of administratively oriented users of large IBM computers.
- GUTS : Gothenburg Universities Terminal System. A comprehensive set of control and service programs to permit the use of keyboard terminals for general computing purposes on an IBM system operating under 0.S. with HASP.

- GUTS Availability : The total number of hours for which the GUTS system was available in the machine for simultaneous use by up to sixteen terminal users.
- GUTS Terminal : The total number of man-hours spent by Time users at active terminals.
- GUTS "Log-on" : The total number of occasions on which Requests individual terminal users attempted to use the GUTS system.
- HASP : The Houston Automatic Spooling Program. A control program to marshal the queue of incoming jobs, schedule them for processing, and release their results to the appropriate output device. It works in conjunction with 0.S.
- Joint Working Group : The Joint Working Group on Information Systems established on TCD initiative to share systems resources by the co-operative development of new systems which, when completed, can be operated independently by the participants who currently include the NUI colleges and TCD with HEA observers in attendance.
- Maintenance Use : Use of the machine by systems analysis and programming staff for the maintenance of existing programs.
- Meter Time : Time during which one or more jobs are active in the system, as recorded by meter.

- Modem : Modulator-demodulator unit, one of which is normally required for signal conversion purposes at each end of a data transmission line.
- 0.S. : IBM System/360 Operating System. This is the main complex of control programs and program libraries needed to run the machine.
- P.A.C.X. : Private automatic computer exchange. A device, similar to an automatic telephone exchange, which enables many terminals compete for access to a limited number of entry ports on one or more computers.
- Port : An entry channel through which one terminal at a time can communicate with the computer. Ports may be "synchronous" or "asynchronous", depending on the communications technique used. The former are normally used for high speed communication only.
- Production Use : Use of the computer by Operations staff for routine productive work.
- SDI Service : The current awareness service based on individual interest profiles operated by the Library.
- SEAS : The SHARE European Association. A European association of scientifically oriented users of large IBM computers.
- TOPS-20 : The main control program on the DECsystem-20.